

THIRD ORDER SUSCEPTIBILITY OF GOLD SULFIDE SOL

by

**Dr. Kenneth LaiHing
Dept. of Chemistry
Oakwood College
Huntsville, AL 35896**

for

**U.S. Army Missile Command
Felicia L. Hereford-Kaigler
Redstone Arsenal
Huntsville, AL 35898-5254**

December 28, 1992

Contract # DAH01-92-P-R021

DISTRIBUTION STATEMENT A

**Approved for public release;
Distribution Unlimited**

DTIC QUALITY EXPECTED 3

19980223 157

AA. *Third order of susceptibility of Good Sulfide Sol*

PLEASE CHECK THE APPROPRIATE BLOCK BELOW:

AO# 497-04-0346

☐ _____ copies are being forwarded. Indicate whether Statement A, B, C, D, E, F, or X applies.

☒ **DISTRIBUTION STATEMENT A:**
APPROVED FOR PUBLIC RELEASE: DISTRIBUTION IS UNLIMITED

☐ **DISTRIBUTION STATEMENT B:**
DISTRIBUTION AUTHORIZED TO U.S. GOVERNMENT AGENCIES ONLY; (Indicate Reason and Date). OTHER REQUESTS FOR THIS DOCUMENT SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ **DISTRIBUTION STATEMENT C:**
DISTRIBUTION AUTHORIZED TO U.S. GOVERNMENT AGENCIES AND THEIR CONTRACTORS; (Indicate Reason and Date). OTHER REQUESTS FOR THIS DOCUMENT SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ **DISTRIBUTION STATEMENT D:**
DISTRIBUTION AUTHORIZED TO DoD AND U.S. DoD CONTRACTORS ONLY; (Indicate Reason and Date). OTHER REQUESTS SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ **DISTRIBUTION STATEMENT E:**
DISTRIBUTION AUTHORIZED TO DoD COMPONENTS ONLY; (Indicate Reason and Date). OTHER REQUESTS SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ **DISTRIBUTION STATEMENT F:**
FURTHER DISSEMINATION ONLY AS DIRECTED BY (Indicate Controlling DoD Office and Date) or HIGHER DoD AUTHORITY.

☐ **DISTRIBUTION STATEMENT X:**
DISTRIBUTION AUTHORIZED TO U.S. GOVERNMENT AGENCIES AND PRIVATE INDIVIDUALS OR ENTERPRISES ELIGIBLE TO OBTAIN EXPORT-CONTROLLED TECHNICAL DATA IN ACCORDANCE WITH DoD DIRECTIVE 5230.25, WITHHOLDING OF UNCLASSIFIED TECHNICAL DATA FROM PUBLIC DISCLOSURE, 6 Nov 1984 (Indicate date of determination). CONTROLLING DoD OFFICE IS (Indicate Controlling DoD Office).

☐ This document was previously forwarded to DTIC on _____ (date) and the AD number is _____.

☐ In accordance with provisions of DoD instructions, the document requested is not supplied because:

☐ It will be published at a later date. (Enter approximate date, if known).

☐ Other. (Give Reason)

DoD Directive 5230.24, "Distribution Statements on Technical Documents," 18 Mar 87, contains seven distribution statements, as described briefly above. Technical Documents must be assigned distribution statements.

USARMC/Redstone

TIM Mayfield

Print or Type Name

Per Dr. Kenneth Laithing

DSN 746-5181

Telephone Number

Jorge J. Chirias
Authorized Signature/Date

Third order Susceptibility of Gold Sulfide Sol

Gold sulfide colloid was prepared by mixing equal concentrations of a sulfur sol and a gold sol. The mixture was heated to 85 °C for 15 minutes.

The sulfur sol was prepared by dissolving solid sulfur in hydrazene then adding distilled water. This was followed by heating for 30 minutes at 75 °C.

The gold sol was prepared by reducing gold chloride with 1% sodium citrate. The mixture was heated and stirred at 85 °C for 30 minutes.

The UV-Visible spectrum of gold sulfide sol is shown in Figure 1. The final concentration was 7.1×10^{-3} M.

The phase conjugate signal intensity was measured using degenerate four-wave mixing (DFWM). The experimental arrangement used is shown schematically in Figure 2. Briefly it consisted of a lens A which focuses the beam on the sample. The optical density filter B was used to vary the intensity of all three beams. Beam splitters BS1 (5%T) and BS2 (50%T) were used to generate the probe, front pump and back pump beams respectively. All beams arrive at the sample simultaneously. The beamsplitter BS3 is used to pick off the conjugate signal which is then focused on a photodiode detector and displayed on a Tektronix 2465 300 MHz oscilloscope. The beam intensity was measured by another detector placed between the sample and the back pump beam and displayed on another Tektronix oscilloscope.

The intensity of the phase conjugate signal used in these

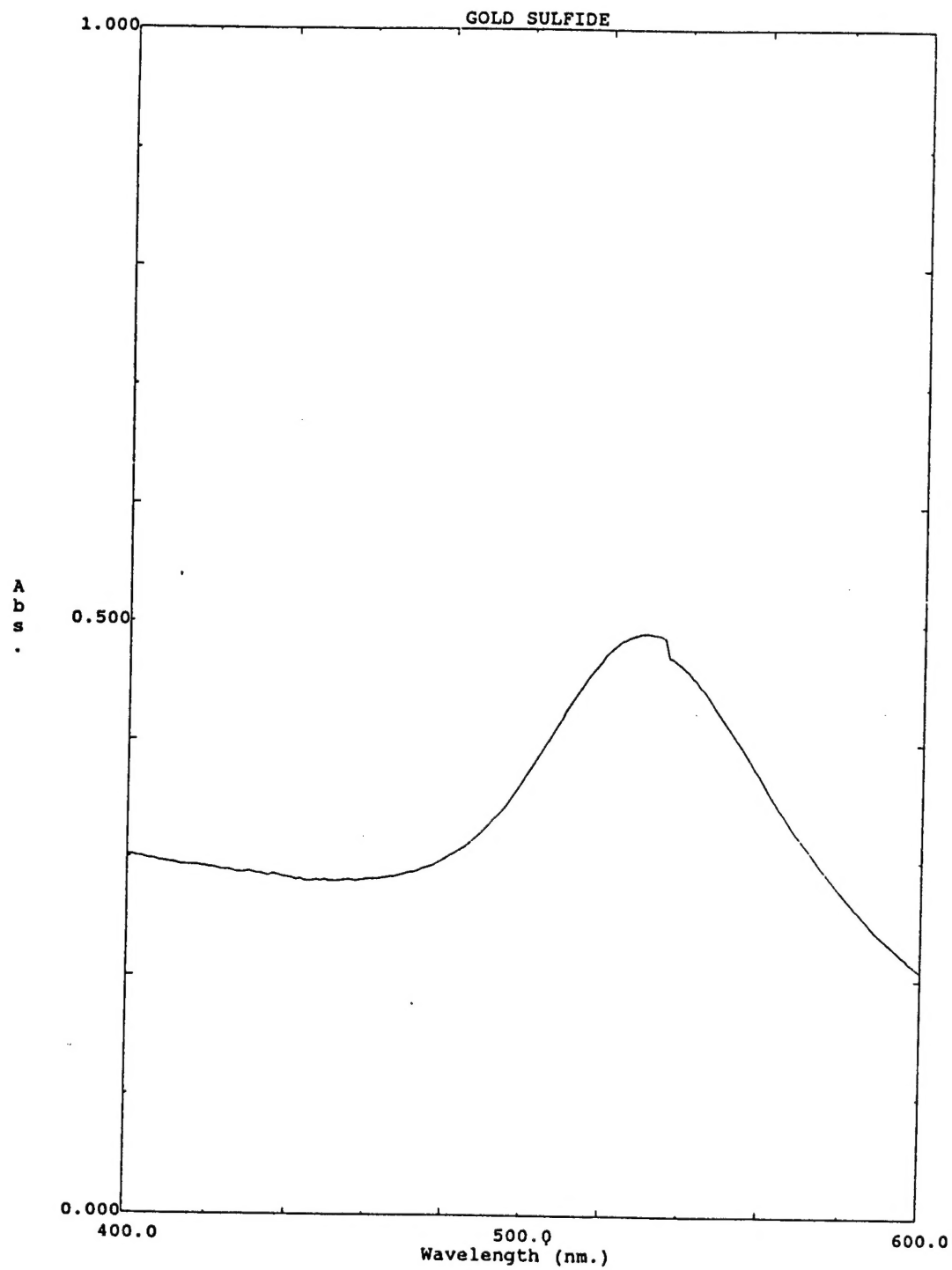


FIGURE 1.

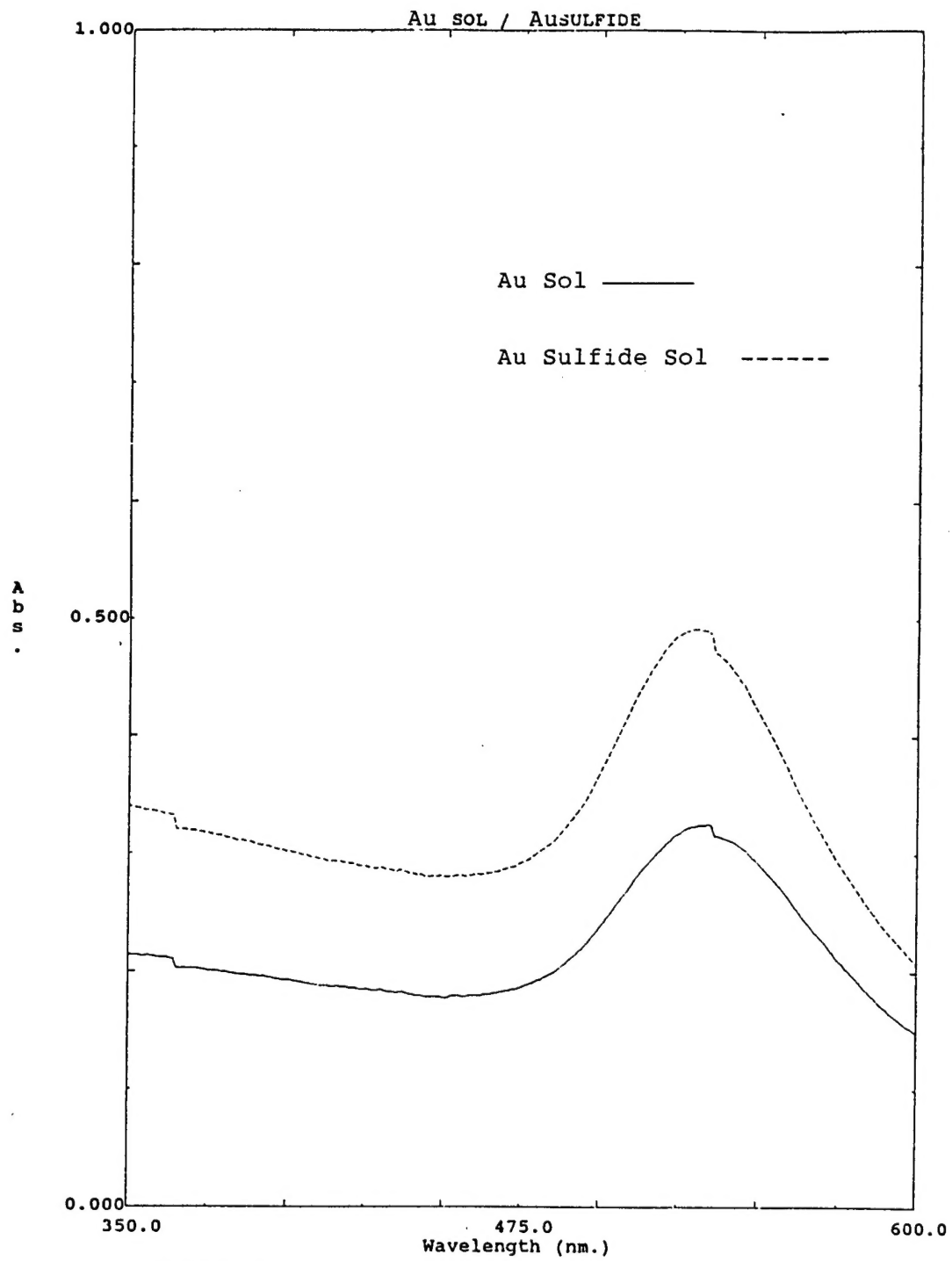


FIGURE 1A.

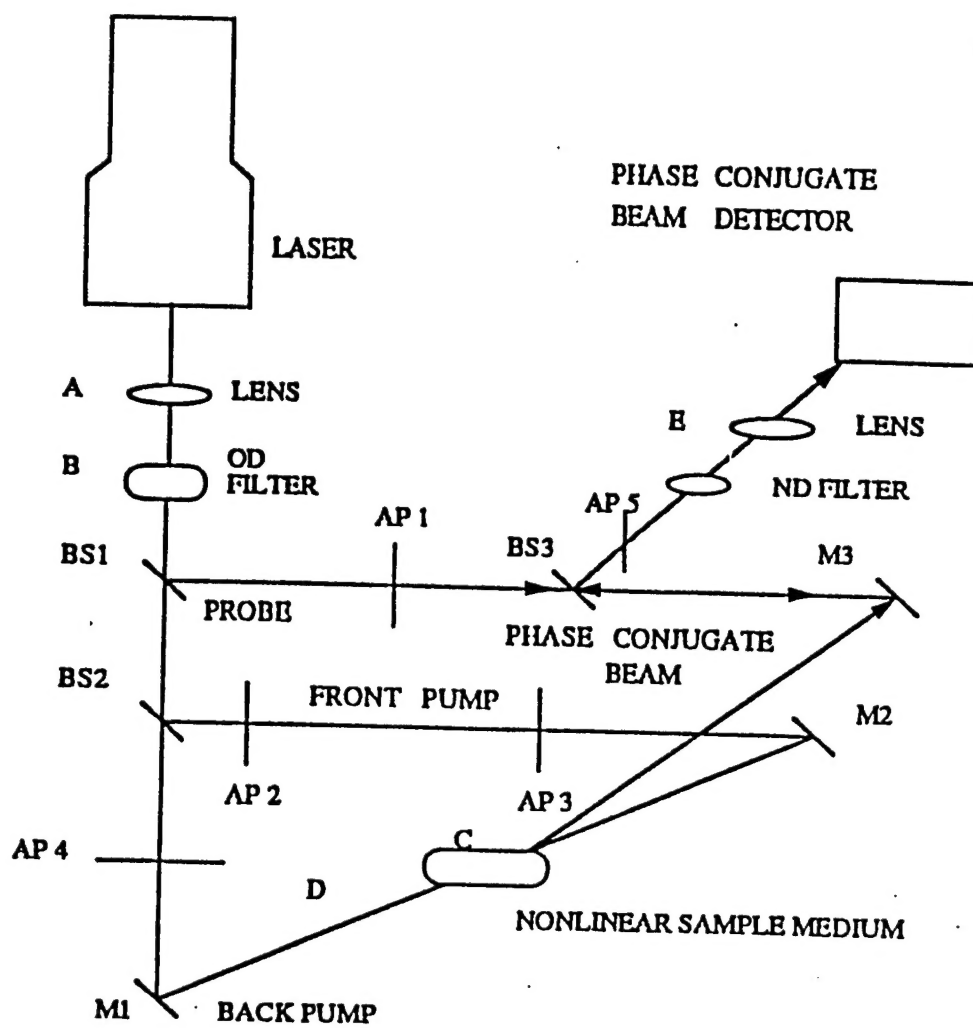


FIGURE 2. Experimental Arrangement for Degenerate Four-Wave Mixing

calculations was obtained from the log-log plot of phase conjugate signal intensity versus the laser intensity. Carbon disulfide was used as a reference. A similar plot was made for carbon disulfide at the same wavelength, 480nm.

The value of X^3 for gold sulfide was 7.73×10^{-12} esu.